NOAA – National Marine Fisheries Service

WEEK THREE
SEPTEMBER 8 – 14

2008 LUTH CRUISE

Studying Leatherback Use of Temperate Habitat Along the Central California Coast

CHIEF SCIENTIST:
Scott Benson

CRUISE LEADER:
Scott Benson

SURVEY COORDINATOR:
Annette Henry

SCIENTISTS (A-Z):
Steven Bograd
Randy 'George' Cutter
Peter Dutton
Karin Forney
Justin Garver
Elizabeth Zele
Juan Zwolinsky

VISITORS:
Amy Hapeman

TEACHER AT SEA:
Mary Anne Pella-donnelly

Weekly Science Summary

Scott Benson (Chief Scientist)

After an important and well-deserved rest for scientists and crew, the NOAA Ship *David Starr Jordan* crossed beneath the Golden Gate bridge on Monday morning for the last time this year under a thick blanket of low clouds. Joining us this leg are acousticians, George 'Randy' Cutter and Juan Zwolinski; oceanographer, Steven Bograd; leatherback turtle expert, Peter Dutton; teacher at-sea, Mary Anne Pella-Donnelly; and Amy Hapeman from the Office of Protected Resources – Permit Division at Head Quarters. We're also carrying some new equipment this leg. Bruce McFarlane (SWFSC – Santa Cruz, California) provided us a another net for jellyfish trawls to replace the net that was destroyed just prior to the end of the first leg…thanks Bruce! Randy and Juan (SWFSC – Advanced Survey Technologies) have brought a pole-mounted multi-beam and side scan sonar system to characterize epipelagic fish and jellyfish that are too close to the surface to be detected by our downward-looking transducers.

With our new pole-mounted acoustic system providing a new vibration to the *David Starr Jordan*, we immediately transited 20-40 miles offshore to an area where the aerial survey team had found a few turtles and some scattered jellyfish during the previous Friday. We also managed to find a few jellyfish within this shelf habitat among numerous humpback whales and a few blue whales. Afterwards, we transited to the north side of Point Reyes.

During prolonged relaxation events, warm water within the Gulf of the Farallones will move northward and around the point, hugging the immediate coast, creating exceptional leatherback foraging conditions in front of the Point Reyes National Seashore. We suspected that conditions were good for such a scenario after reviewing some remotely sensed data and monitoring the movements of a turtle that carries a satellite tag we attached during September 2007. Upon arrival at our destination, we were not disappointed… gigantic proportions of large *Chrysaora fuscescens* (sea nettles)! Our tagged turtle was in this location while we were in San Francisco and she left some calling cards of her visit with numerous partially eaten jellyfish floating languidly at the surface. We attempted a brief two minute trawl to sample the jellyfish but our replacement net could not hold the haul, releasing the jellyfish back into the sea. Score one for the jellyfish. Disappointed and covered with stinging jellyfish slime, we proceeded to dip net a few of the creatures before retreating offshore again.

WEEKLY SCIENCE SUMMARY - *CONTINUED*

Scott Benson
holding a sea nettle

"Upon arrival at our destination, we were not disappointed… gigantic proportions of large Chrysaora fuscescens *(sea nettles)!"*

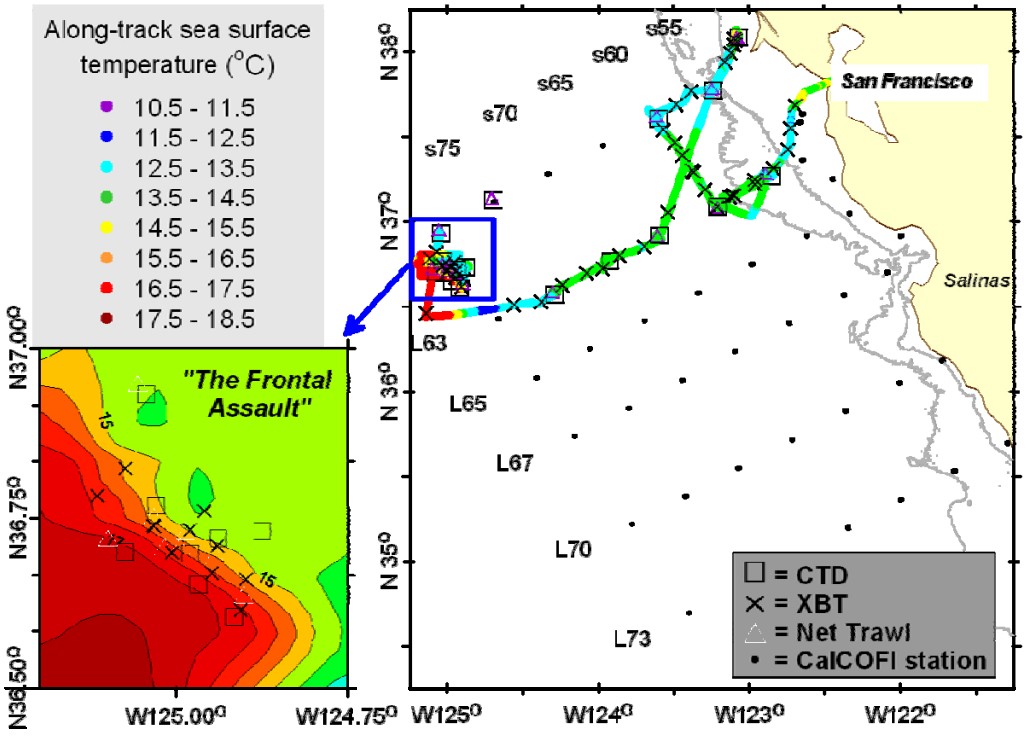


FIG 1. Week 3 *David Starr Jordan* trackline with sea surface temperatures. The team spent the majority of Week 3 characterizing the oceanographic conditions of a frontal zone nearly 150 miles off Monterey, California.

Justin Garver
in the oceanography lab

During the transit offshore, Chico Gomez and Joao Alves from the DSJ deck department, and turtle scientist, Peter Dutton, devised a plan to repair our net by attaching the rear portion of the Moss Landing net, recovered from the leg one incident, to the replacement net we received from Bruce McFarlane. After multiple hours of sewing, stitching, and ranchero folk songs, we had a new, stronger, hybrid…"Franken-net". The improved net has served us well so far.

Accompanied by an assortment of small passerines that fly about the dry lab and perch atop our laptop computers and other equipment, we made our way offshore to the edge of a warm water (18°C) eddy, where we found swordfish earlier. During the first week of our cruise, high winds and large swells chased us out of this area before we finished our intended work, and the forecast this week predicted much better conditions. We made a frontal assault on the sharp gradient between the warm water at the core of the eddy and the cooler water to the east. Our oceanographic and hydroacoustic instruments have provided an interesting perspective of this persistent aggregation mechanism, about 150 miles west of Monterey.

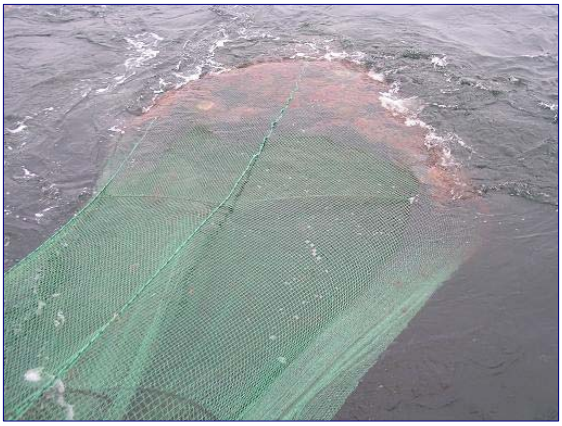
Victor Pinones, Joao Alves, and Peter Dutton piecing together the 'Franken-net'

Peter Dutton holding a Humbolt squid (*Dosidicus gigas*)

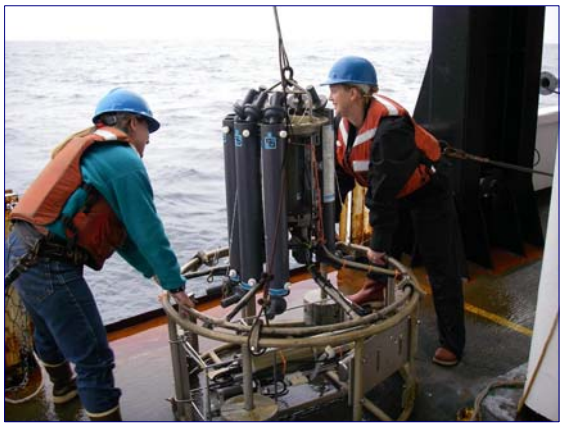
Seabirds such as the Black-footed Albatross (above) were anticipated during LUTH, but birds such as the Western Tanager (below) unexpectedly took residence on the ship when more than 100 miles offshore, probably blown off course during their southbound migrations.

WEEKLY SCIENCE SUMMARY - *CONTINUED*

The associated strong currents and gradient orientation made for some challenging brain twisters as we've ascended the learning curve of sampling this feature. The adaptive sampling regime has been mentally exhausting but worthwhile, yielding small trawl yields of sea nettles, moon jellies, and numerous sea gooseberries. Previous telemetry data of leatherback movements has indicated occasional use of similar offshore waters. Although prey is much less abundant in these deep offshore areas in comparison to the coastal zone, we believe we have found a fast food hotspot on the trans-Pacific highway, and documented the physics that create it. The week ended with good evening's haul of Humboldt squid – right at the edge of the front, of course. We'll bring back squid parts for our colleagues at SWFSC–Fishery Ecology Division, Santa Cruz.



Net-tows just northwest of Point Reyes during Week 3 yielded substantial jelly hauls. These hauls proved too large for the net to handle and the catch was lost when the net opened up.



Regardless of weather conditions and light levels, the CTD was deployed up to five times daily on Leg 2 of LUTH 2008. Pictured here are Karin Forney and Liz Zele deploying the CTD on one of the calmer sea days.

Computer programming and analysis of satellite weather data has been an around-the-clock exercise during LUTH 2008. Pictured here are Steven Bograd and Karin Forney discussing yet another computer application to enhance data collection efforts.

Deploying a bongo net during LUTH 2008

Before each trawl, the 'big eyes' were used to search for marine mammals in the area

Common dolphin (*Delphinus delphis*)

OCEANOGRAPHIC DATA COLLECTION

STEVEN BOGRAD, KARIN FORNEY, JUSTIN GARVER, AND ELIZABETH ZELE

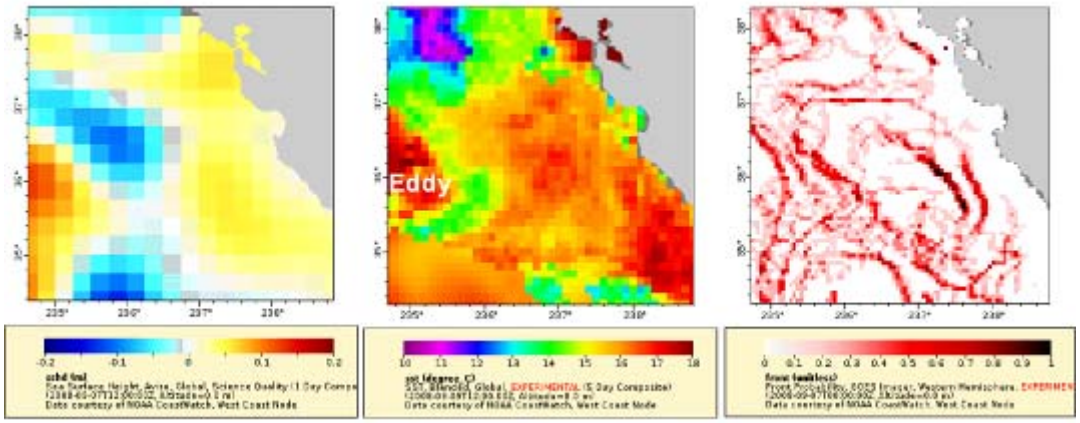


FIG 2. Satellite images of the LUTH study area, showing a warm-core eddy at outer edge: (a) sea surface height deviation, (b) sea surface temperature, and (c) frontal probability. Maps provided daily courtesy of David Foley (NOAA-CoastWatch).

JELLIES ON THE EDGE

Towards the end of the week, we encountered the edge of an offshore warm core eddy (Figure 2) and subsequently noticed big changes in the surrounding biology --- large schools of common dolphins (*Delphinus delphis*) appeared, strong acoustic backscatter signals were concentrated at the sharpest temperature gradient, and the net trawls showed a change in species composition and abundance across the edge of the eddy. Convergence at the outer edge of warm-core eddies tends to aggregate prey, and thus we expected to find higher abundances of top predators here as well. Although the net trawls were mostly empty within the warm waters of the eddy, several species of jellyfish were caught along and on the cold side of the eddy edge, including the leatherbacks' favorite, sea nettles (*Chrysaora fuscescens*). We were surprised to find these jellies so far offshore, and we suspect they may have been entrained in the eddy when it was closer to the coast and were advected with it offshore. Eddies and offshore frontal features such as these could be important areas for leatherbacks to stop and snack as they head toward "Jelly Lane" (see Week 2 report). We spent two days conducting fine-scale sampling of the eddy, and we look forward to analyzing these data when we return to land.

"The Jelly Hunters": Scott Benson, Victor Pinones, Peter Dutton, and Joao Alves with samples collected along the offshore front during Leg 2 of LUTH 2008

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Randy Cutter with yet another Humbolt squid

Amy Hapeman, from the NOAA HQ Permits Office was a visitor on Leg 2, assisting with a variety of research activities on the *Jordan*

ACOUSTIC STUDIES

RANDY CUTTER AND JUAN ZWOLINSKI

The offshore eddy offered an opportunity to examine acoustic backscatter and jellyfish occurrence across a strong oceanographic front. On September 12, we conducted a transect into the eddy and back out, to document biotic and abiotic features. As we transited from Point A to B (Figure 3), the EK60 echograms contained distinct patterns indicating aggregations of acoustic scatterers associated with the rapid change in sea surface temperature at the front. Prior to arriving at the front, the record from the cooler water shows a narrow upper scattering layer (from the transducers to a depth of ~ 20 m), with sparse scatterers for all frequencies, and a denser aggregation from 25 to 50 m (Figure 4a). Evidence of turbulence and mixing water masses at the front, extending to a depth of 200 m was apparent in the 70 and 200 kHz echograms (Figure 4b). Where the surface temperature stabilized, an aggregation of scatterers was found from ~ 50 to 80 m depth in all frequencies (Figure 4c). In the area with warm surface water, the scatterers were aligned in a thin layer at the thermocline depth (Figure 4d). At the northern cold side of the front, the surface scatterer aggregation was dense from the transducer to 25 m in all frequencies, and to 50 m in 70 and 200 kHz (Figure 4e). Moving away from the front into cooler water toward the north, higher levels of scattering begin to appear in the dense surface aggregation (Figure 4f). Detailed analysis of these data are underway to apportion the scattering to biological groups and determine if the various spatial aggregations of scatterers were associated with different taxa.

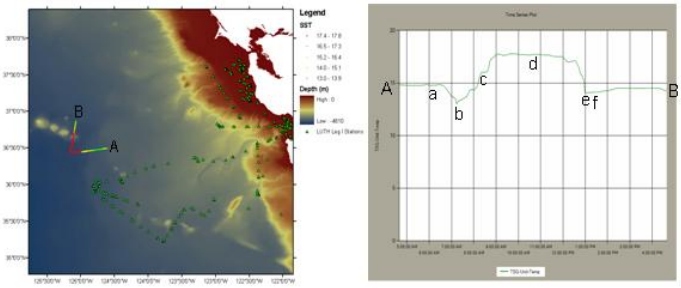

FIG 3. Map of the transect on 12 Sept. 2008, through a front, color-coded by sea surface temperature (°C), and LUTH 2008 stations from Leg 1 (left). Sea surface temperature record along the transect from Point A to B (right). Lower case letters correspond to echograms in Figure 4.

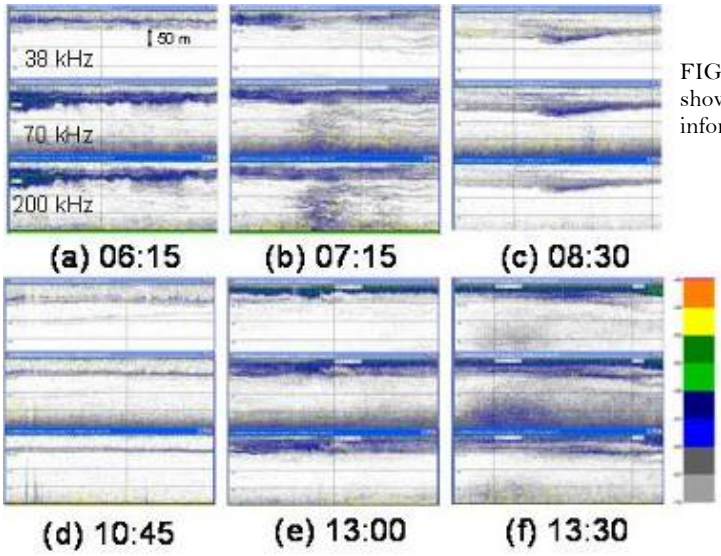

FIG 4. Echogram data screen, showing acoustic backscatter information. See text above.

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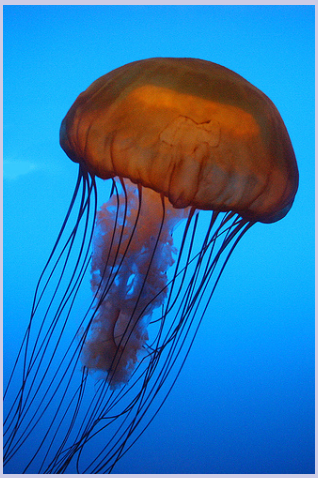
ACOUSTIC STUDIES – *CONTINUED*

MULTIBEAM DATA WITH JELLYFISH

A principal use of backscatter data is to determine the presence of midwater organisms such as jellies.

During Leg II of LUTH, we have also been using a multibeam echosounder to detect jellyfish and other organisms along track. The multibeam echosounder is a Kongsberg-Mesotech SM20 with a SM2000 transducer that is pole-mounted on the port side of the ship. This 200-kHz SM20 sonar forms 128 beams over a swath spanning 180°. Because the sonar head is tilted 30° to the port side of the ship the swath image spans from the sea surface on the port side to approximately 60° to the starboard side (Figure 5). The advantage of the side-looking multibeam over conventional, vertical hull-mounted sounders is its capability to insonify the entire water column, from the sea surface to the seafloor (in water depths to ~ 250 m). It can thus image a portion of the water column missed by typical echosounders. SM20 data from 11 September, 2008 were acquired from an area near Point Reyes, California (38° 07.427' N, 123° 05.605' W), where jellyfish were known to be common, and where they were visible at the surface during our transit. The SM20 insonified and detected many jellyfish (Figure 5), which our net tow data revealed to be large *Chrysaora fuscescens* (~30-50 cm bell diameter and weighing 3-5kg).



Sea nettle

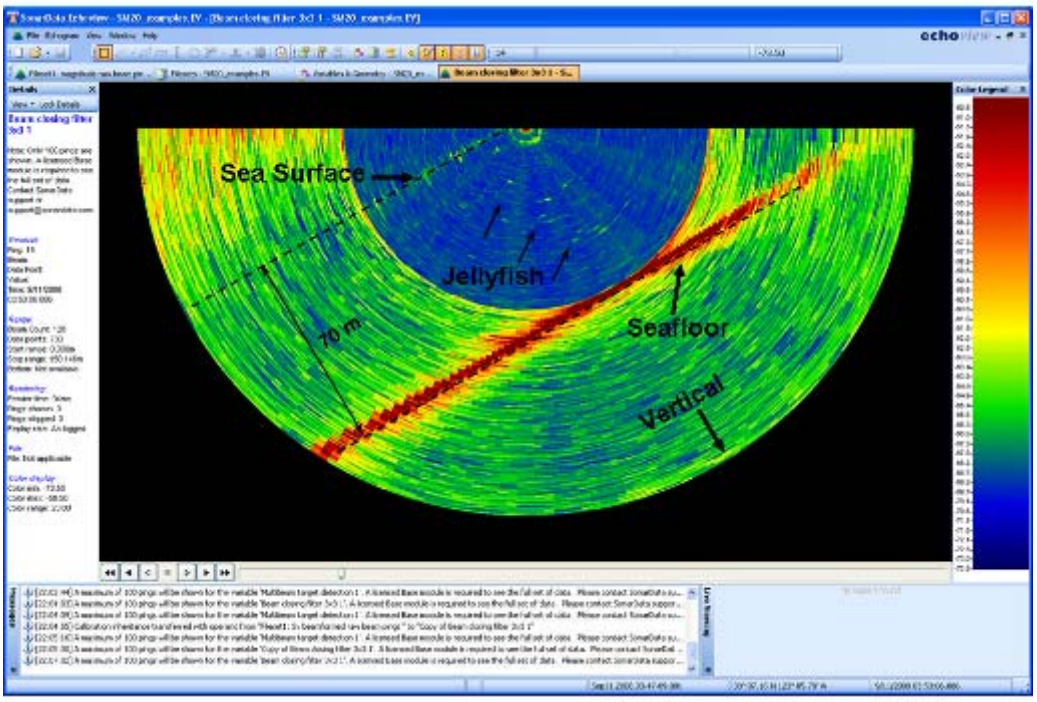


FIG 5. Data from the SM20 multibeam in an area with large *Chrysaora fuscescens* jellyfish.

COMMAND:

CO –
LCDR DEMIAN BAILEY
ACTING XO –
LT JOHN CROFTS
OPS –
ENS KYLE BYERS
NAV –
ENS RON MOYERS

ELECTRONICS:

CHIEF ET –
KIM BELVEAL

GALLEY:

CHIEF STEWARD –
RAINIER CAPATI
2ND COOK –
MIKE SAPIEN

DECK DEPARTMENT:

BOS'N –
CHICO GOMEZ
SKILLED FISHERMAN –
VICTOR PINONES
FISHERMAN –
JOAO ALVES
VLADIMIR ZGUTNITSKI

ENGINE ROOM:

ACTING CHIEF ENGINEER –
CHRIS DANALS
2ND ENGINEER –
JOHN HOHMANN
WALTER LAU
JUNIOR ENGINEER –
SAM VELEZ
OILER –
CARLITO DELAPENA
GENERAL VESSEL ASS'T –
JUN ORODIO

INTRODUCING THE DAVID STARR JORDAN

ENS KYLE BYERS

First off, I'd like to say hello to all of you on shore who have been following the adventures of NOAA Ship *David Starr Jordan* over the last several weeks. It's been a rewarding and interesting cruise for all involved and I am glad you can take part- even if it's only from afar. So, for all of you who are not lucky enough to be with us, here's a brief tour of the *Jordan*, top to bottom. The *Jordan* is really a floating home for us crew - we spend more time out here than in our actual homes. So… welcome, and make yourselves comfortable!

BRIDGE

This is where the officers do their work. They monitor radios, radars, depth sounders, and navigational equipment, maintained by our always-in-demand electronics technician, to keep everyone onboard safe- all while maneuvering for our varied operations. Driving is the one of the best parts of an officer's job and it's all done here. It takes skilled ship-handling to ensure the precise and accurate sampling that a successful scientific cruise requires.

CREW'S LOUNGE

Our lounge is a haven when you are out in the middle of the ocean and Oh! there goes your satellite TV coverage. We're fortunate to have an extensive collection of Hi-8 (yes, ancient technology) tapes for our viewing pleasure.

MESS DECK

Our stewards are kept very busy out here: making three meals a day, maintaining cleanliness of the ship, and gifting (or cursing some would say) us with cakes and cookies. We gather on the mess deck for their meals, as well as movies, games, and just socializing in general. Most importantly, this is where the ice cream is kept.

ABOARD THE DAVID STARR JORDAN – *CONTINUED*

David Starr Jordan (1851-1931) ichthyologist, educator, writer

The ship is named after Dr. David Starr Jordan Dr. Jordan was one of the best-known naturalists and educators of his time. He wrote more than 50 books and published over 600 scientific papers on topics ranging from ichthyology (the branch of zoology dealing with fish) to advancing world peace. In 1885, at the age 34, Dr. Jordan became president of Indiana University. In 1891, he became the 1st president of Stanford University, a post he held for 25 years. Dr. Jordan was a member of the California State Fish Commission, and his investigations of the exploitation of the salmon and fur seal populations helped save these species.

FANTAIL

The *Jordan* is a hard-working ship capable of a wide variety of operations-oceanographic tows, trawling, long-lining, ROV deployments, and the list goes on. The fantail is where most of our scientific operations happen. In support of these missions, we have a dedicated, experienced, and highly talented deck department that makes it all happen. Though I think they're mostly in it for the fish.

ENGINE ROOM

Here is where we get our go-juice. We might not go fast (9 knots on a good day, 10 knots with a following sea, wind, and current), but we do go! This ship has been at it since 1965 - and it's due to the hard work and expertise of our fantastic engine department that we continue to be able to support scientific research so consistently.

To truly experience the *Jordan,* you've just got to see it in person, stay aboard for a couple weeks, and fully immerse yourself in shipboard life. So maybe we'll see you out here sometime!

A BRIEF HISTORY OF THE NOAA SHIP *DAVID STARR JORDAN*

The *David Starr Jordan* was built in Sturgeon Bay, Wisconsin in 1964 and commissioned in San Diego, California, in 1966. The ship was designed and built for the U.S. Bureau of Commercial Fisheries, which later became part of the National Oceanic and Atmospheric Administration, for the purpose of fisheries research in the tropical Pacific. Since commissioning, the *David Starr Jordan* has logged over a million miles while studying the biological and physical oceanography of the eastern coast of the northern Pacific and the eastern tropical Pacific. The *David Starr Jordan* is an integral part of the marine mammal and sea turtle census efforts conducted by the Protected Resources Division of NOAA Fisheries' Southwest Fisheries Science Center as well as support for the extensive fisheries research conducted by the Center's Fisheries Ecology and Fisheries Resources Division. The vessel is operated by NOAA's Office of Marine and Aviation Operations.

NOAA-NATIONAL MARINE FISHERIES SERVICE

AERIAL TEAM COORDINATOR

ERIN LACASELLA

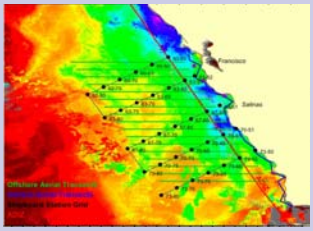
NOAA TWIN OTTER PILOTS:

NICOLE CABANA

JASON MANSOUR

OBSERVERS:

NO FLIGHTS THIS WEEK



Although there were no flights during Week 3, the Aerial Team assisted in a big way, sending daily emails to the *Jordan* with vital oceanographic information. Pictured here is a sea surface temperature image with LUTH oceanographic sampling stations. Data courtesy of Dave Foley (JIMAR and SWFSC-ERD). See Figure 2 for additional data examples.

AERIAL SURVEYS

ERIN LACASELLA

During Week 3, the fog has been very persistent and kept us grounded, although it has made weather monitoring more straightforward with a consistent 1200- to 2000-ft deep layer of fog (Figs. 6a, b, c). Weather monitoring and decision making to fly can be rather challenging since aerial surveys are a fine balance of conditions, typically between wind (Figure 6d) and fog. The disappearance of fog usually requires a frontal system or the wind to blow it around, however too much wind affects the sea state, viewing conditions, and effectively the value of the data collected. With respect to fog and/or cloud cover, while flying surveys at 650 feet in altitude we can potentially fly under a ceiling of clouds if high enough. The challenge then becomes the dark, sort of reflective appearance on the water (similar to the back of aluminum foil), therefore inhibiting our ability to see into the water column. Determining good weather conditions can be a fine line for successful aerial surveys and, luckily, through constant monitoring we are able to make appropriate calls. With the epic weather and survey time we had during Week 2 of LUTH we expected the weather window to come to a close. Hopefully Week 4 will bring good flying weather to complete offshore transects and potentially more turtle tagging with the *Jordan*.

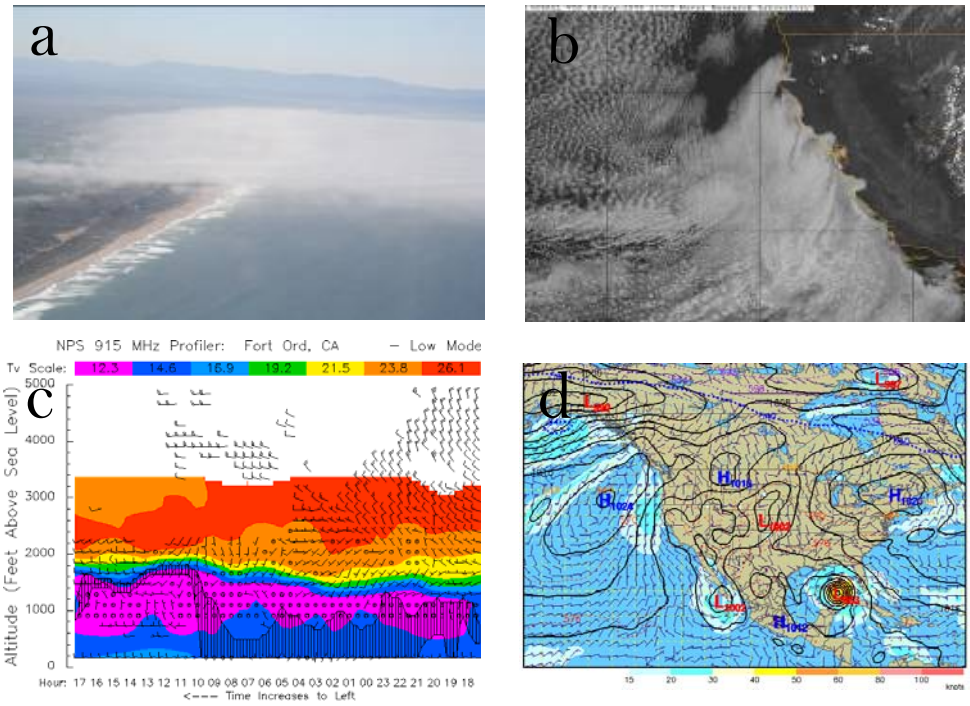


FIG 6. Each day, when determining whether to conduct aerial operations, the LUTH aerial team used a variety of tools to monitor weather conditions. These included (a) the naked eye to look at fog presence near Monterey (pictured here is a fog layer rolling into Monterey Bay); (b) satellite weather images from a variety of websites (in this frame, a fog layer can be seen off most of California); (c) weather profiler data at Fort Ord, courtesy of the Naval Postgraduate School in Monterey (notice the pronounced inversion (i.e. fog) layer); and (d) daily GFS weather models showing wind patterns over North America.

TEACHER'S PICS

Wilson's Warbler hitching a ride on the *Jordan*

Trawl net ready to be deployed

Sea nettles caught in a net trawl

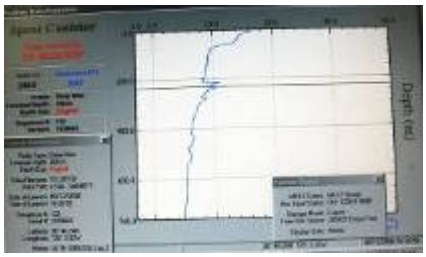
A LOG FROM OUR TEACHER AT SEA

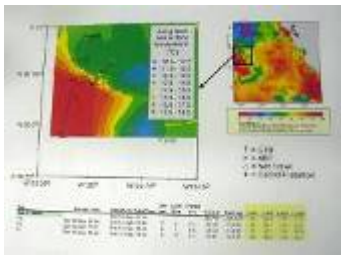
MARY ANNE PELLA-DONNELLY

The first week of the second leg of the LUTH survey has allowed me to observe the dynamic nature of scientific research. With the goal to determine the abundance of jellyfish in waters of different temperature ranges, we headed west to a region known to have a warm current eddy butting up against colder water. The NOAA Ship *David Starr Jordan* has worked to adapt to ever changing plans as the science team recalculates their net deployments due to oceanographic conditions around this temperature gradient. Net trawls and CTD deployments have been conducted at the cold edge and warm edge to discern which conditions are most favorable for jellyfish. The subsurface current has been a factor that was unexpected, and has caused some changes in plans due to the current pulling the boat.

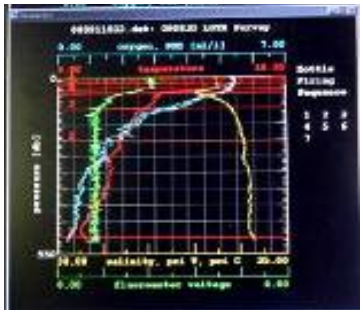
As the teacher on board this leg, it is my goal to bring some of this research back to junior high students at the level they can understand it. Lessons are being developed using the data gathered to show students the practical applications of graphing skills, mathematical understanding, and how physics and physical science are used in oceanographic work. Each data set that is collected has the potential to give students an opportunity to take classroom instruction and use it to understand new research. The importance of accurate measuring, weighing and recording that data can be clearly seen.

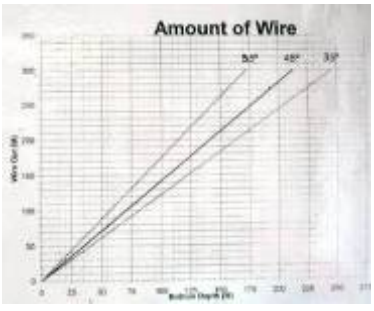
BEGINNINGS OF FUTURE LESSON PLANS.....





XBT graph indicating temperature decrease with depth (left), satellite-generated chart showing temperature gradient in study area (right).





CTD data used for a graphing lesson showing that an understanding of chemistry and physics is needed in marine sciences (left); students will learn trigonometry by graphing bongo net deployment parameters such as total line deployed and angle of descent (right).